

## ABSTRACT

Electrochemical fuel cell stacks comprising a plurality of membrane electrode assemblies stacked in an alternating manner, such that the polarity of adjacent membrane electrode assemblies are opposite, are disclosed. The fuel cell stacks comprise a plurality of membrane electrode assemblies, each membrane electrode assembly comprising an anode fluid distribution layer, a cathode fluid distribution layer, a polymer electrolyte membrane interposed between the anode and cathode fluid distribution layers, an anode electrocatalyst layer interposed between the polymer electrolyte membrane and the anode fluid distribution layer, and a cathode electrocatalyst interposed between the polymer electrolyte membrane and the cathode fluid distribution layer, wherein the plurality of membrane electrode assemblies are stacked in an alternating manner such that the polarity of adjacent membrane electrode assemblies are opposite, and wherein the plurality of membrane electrode assemblies are externally jumpered. Methods for shutting down the fuel cell stacks are also disclosed.

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